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NASA DC-8 Airborne Laboratory

NASA is using a McDonnell Douglas DC-8 aircraft as a flying science laboratory. The platform aircraft, based at NASA Dryden Flight Research Center, Edwards, CA collects data for many experiments in support of scientific projects serving the world scientific community. Included in this community are NASA, federal, state, academic, and foreign investigators.

Data gathered by the DC-8 at flight altitude and by remote sensing have been used for scientific studies in archeology, ecology, geography, hydrology, meteorology, oceanography, volcanology, atmospheric chemistry, soil science, and biology.

NASA's Douglas DC-8 Flying Laboratory soars over Southern San Gabriel Mountains, CA . NASA photo EC98-44428-2 by Carla Thomas.

Missions

The DC-8 flies three primary types of missions: sensor development, satellite sensor verification, and basic research studies of the Earth's atmosphere.

Sensor Development

Because it flies in the Earth's atmosphere, the DC-8 offers a comparatively inexpensive way to test and verify prototype Space Shuttle or satellite instruments before they are flown in space.

Scientists use the DC-8 to develop ideas in instrument technology, test new instruments, and make modifications based on the flight results. NASA and industry can save time and money because they can correct potential problems before the instruments are launched into space. In this way, flight proven hardware can lead to a substantial savings in time and resources.

For example, as part of the Global Backscatter Experiment, managed by the NASA Marshall Space Flight Center, Huntsville, AL, the DC-8 helped measure the background atmospheric data necessary for the development of the Laser Atmospheric Wind Sounder. This satellite is scheduled to be launched into space in 2001. Its mission will be to relay accurate global wind information back to Earth, through the analysis of atmospheric aerosol backscatter data. The DC-8 has carried the

backscatter experiment to the South Pacific on two deployments to test the laser backscatter techniques.

Satellite Sensor Verification

Once in orbit, satellite instruments may send back billions of bits of data every day. The DC-8 helps scientists answer questions about the accuracy of the data obtained and how to interpret it. For these types of missions the DC-8 flies under the satellite's path, using instruments to compile the same information the satellite collects. Through this process, algorithms used to interpret satellite data are evaluated and updated to reflect the results verified by the DC-8 instrumentation.

In August and September 1998, the DC-8 is scheduled to fly along the same path as NASA's Tropical Rainfall Measuring Mission (TRMM) satellite, which was launched Nov. 1997. These missions are part of the second phase of the Texas Florida Underflights (TEFLUN) experiment, which uses a combination of airborne and surface-based measurements, including DC-8 measurements, to complement and verify the satellite data.

NASA'S DC-8 Airborne Science Laboratory banks right as it soars over the Dryden Flight Research Center complex on a low-level pass. NASA photo EC98-44444-18 by Jim Ross.

Basic Research Studies

The DC-8's extended range, prolonged flight duration, large payload capability, and laboratory environment make it one of the premier research aircraft available today. Combined with other aircraft, satellites, or ground stations, the DC-8 complements and extends the range of any instrument package, allowing scientists to successfully address today's planetary issues, like global warming and deforestation.

As part of a series of Arctic ozone experiments, the DC-8 flew in the polar regions to collect atmospheric information that may contribute to human understanding of ozone depletion. In 1987, 1989, and 1992, the aircraft flew over the North and South Poles, carrying numerous instruments to measure atmospheric conditions that might decrease ozone levels. Teamed with NASA's ER-2 high altitude research aircraft and scientists from NASA centers, the National Center for Atmospheric Research, and several universities, the DC-8 has played an important role in attempting to solve the mystery.

During the Global Tropospheric Experiment, managed by NASA's Langley Research Center, Hampton, VA, the DC-8 helped increase understanding of the troposphere (atmosphere up to seven miles from the Earth's surface), and how humans and natural causes combine to influence the quality of the air we breathe. The experiment began in the early 1980's as a tropospheric chemistry experiment. Today, it is providing a powerful new approach to understanding the profound changes human activity generates and the possible long-term effects these changes may have on the habitability of Earth.

Another basic research mission featured the Airborne Synthetic Aperture Radar. The radar, developed by the NASA Jet Propulsion Laboratory, Pasadena, CA, more than a decade ago, is an all-weather imaging device that can penetrate clouds, forest canopies, thin sand, and dry snow packs. During missions in Spring 1998, the radar gathered information for use in topographic mapping, geologic research, and hydrology.

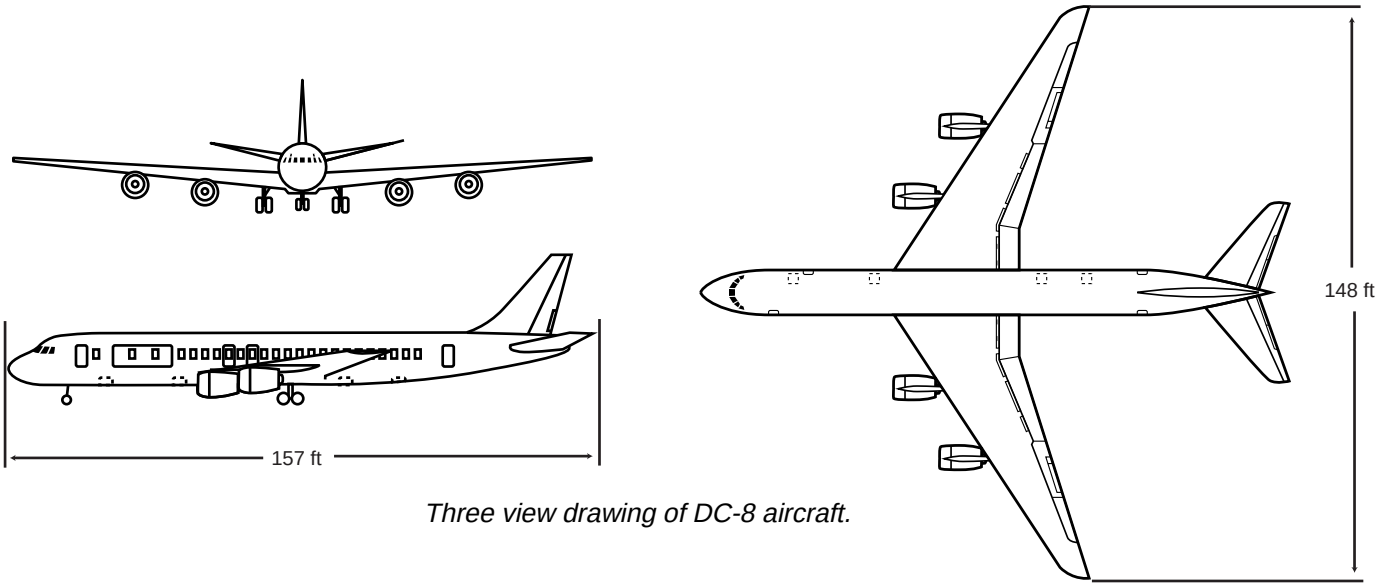
Deployment Locations

Anchorage, AK
Fairbanks, AK
Guam, USA
Hickam AFB, HI
Wake Island
Aviano, Italy
Okinawa, Japan
Yokota AB, Japan
Acapulco, Mexico
Windhoek, Namibia
Cebu, The Philippines
Stavanger, Norway
Recife, Brazil
Rio de Janerio, Brazil
Edmonton, Canada
Punta Arenas, Chile
Christchurch, New Zealand
San Jose, Costa Rica
Stuttgart, Germany
Hong Kong, China
Keflavik, Iceland
Shannon, Ireland
Ascension Island
Darwin, Australia
Melbourne, Australia
Perth, Australia
Townsville, Australia
Brasilia, Brazil
Lajes, Azores
Prestwick, Scotland
Papeete, Tahiti
Madrid, Spain
Bangkok, Thailand
Johannesburg, South Africa

DC-8-72 Aircraft

The NASA DC-8 is a four engine jet transport aircraft that has been highly modified to support the Agency's Airborne Science mission. The aircraft, acquired in 1985, is 157 ft long with a 148-ft wingspan. It can fly at altitudes from 1,000 to 41,000 ft for up to 12 hours, although most science missions average 6 to 10 hours.

Among the aircraft's features are wing pylons (for aerosol sampling), a gyro-stabilized pointing and tracking mirror system, a dropsonde delivery tube, atmospheric chemistry sampling probes, and several reinforced ports that accept experiments pointing in virtually any direction. Experiment support facilities include weather radar, an integrated navigation management system, a satellite-based time code generator, a stand-alone Global Positioning System, and a weather satellite receiver system. Each experiment is supported by a data acquisition and distribution system providing navigation, aircraft conditions, and environmental data measured by facility sensors.



Three view drawing of DC-8 aircraft.

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